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## (54) IMPROVEMENTS IN WASHING AND CLEANING ARTICLES


(71) We, NYLONGE CORPORATION, a body corporate organised and existing under the laws of the State of Ohio, United States of America, of Cleveland Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—


The present invention relates generally to improvements in wiping, washing and cleaning articles and particularly to an improved soft, highly water absorbent, web or cloth, and a method of producing the same.

Wiping and cleaning webs are broadly of two types, the paper towel or napkin type which is generally formed of randomly oriented wood cellulose fibres in a relatively compact non-woven state produced on conventional paper producing equipment and the woven or knitted cloth type which is conventionally formed of cotton fibres. The conventional wiping and cleaning webs possess numerous drawbacks and disadvantages which characterize the particular type of web. Woven or knitted cotton cloth is generally coarse and commonly not lint free and is too expensive to be considered disposable and so must be regularly laundered. The paper towel, on the other hand, is likewise coarse, of low water absorption, and slow water take-up and very weak both in a dry and wet state. These webs have been treated with polymeric resins to increase their wet strength but such treatment increases the cost of the product and reduces its water absorption qualities and increases its coarseness. It is thus clear that the conventional wiping and cleaning webs leave something to be desired and generally represent a compromise.

Numerous structures have been proposed in attempts to avoid the disadvantages of the conventional cloth and paper webs but these structures fail to remedy the important defects thereof. A laminate consisting of two or more tissue paper webs cemented together by regenerated cellulose derived from intermediate layers of foamed viscose has been described but this product is relatively hard and stiff, particularly when dry, and possesses a slow water take up. It has also been suggested to laminate carded cotton fleeces with resin foams but the resulting product is of low water absorption and permeability. Various other composite products have been proposed but they do not satisfy the need for an inexpensive web of high absorption and rapid take-up of water, which web is soft and strong when both wet and dry.

It is an object of the present invention to provide an improved cleaning and wiping article.

Another object of the present invention is to provide an improved disposable highly water absorbent cleaning and wiping cloth which is very soft and possesses a rapid water take-up and great strength both in wet and dry state which is characterized by its low cost, versatility, convenience of use and attractive appearance.

Accordingly the present invention provides a soft, water absorbent product comprising a three dimensional reticulated matrix of regenerated cellulose bonded fibres produced by regenerating a foamed viscose having staple reinforcing fibres distributed therethrough, and a fibrous layer additionally anchored in a face of the fibre-containing regenerated cellulose matrix.

Preferably the foamed viscose has an alkalinity corresponding to a ratio of sodium hydroxide to the cellulose dissolved in the viscose exceeding 0.9:1.0.

It has been discovered that a laminate of a reticulated regenerated fibre-containing cellulose layer and a fibrous layer in which the fibres at the layer interface are at least


[Price 33p]

partially embedded in the regenerated cellulose layer possesses numerous highly desirable characteristics and features. Among these are a high water absorption capacity, a rapid water take-up and great softness when wet and dry and a very high wet and dry strength. The improved article also possesses a high abrasion and wear resistance, is lint free, inexpensive, so as to be economically disposable, and possesses numerous other advantages.

The present invention provides a highly water absorbent web, sheet or slab material which is soft, pliable and of high strength when both wet and dry and comprises a reticulated matrix of foamed regenerated fibre-containing cellulose, having at least one fibrous layer at least partially embedded in the matrix. In a preferred embodiment the reticulated matrix of foamed regenerated cellulose is sandwiched between two fibrous layers.

The web or sheet is of a thickness of 0.15 millimeters to 5 millimeters or more with the weight of the fibre layer or each outer fibre layer being between 4 and 60 grams per square meter and the fibre layer or each outer fibre layer constitutes between 2% and 85% by weight of the dry product. The regenerated cellulose constitutes at least 15% by weight of the matrix, and advantageously in excess of 20% thereof and preferably constitutes between 15% and 95% by weight of the dry end product.

The reinforcing fibres are advantageously of relatively small staple length preferably averaging between 1.5 mm and 4 mm. although longer average staple lengths may be employed whereas the outer fibre layers are advantageously of relatively large staple length preferably averaging between 10 and 60 mm or may be continuous filaments. Advantageously the matrix reinforcing fibres are derived from a cellulose pulp, for example a wood pulp, while the outer layer fibres are advantageously cotton or rayon fibres which are for the most part randomly oriented and three dimensional and independently and freely interrelated such as a fleece or web of randomly oriented fibres for example of the nature produced by the Rando web forming process in the known manner.

Alternatively the outer layers may be knitted or woven or otherwise formed into a mesh or open pore fabric with the fibres or filaments arranged in a predetermined pattern such as by joining the filaments or fibres at their points of intersection and the fibres and filaments may be randomly distributed and joined by fusion or adhesively at their intersection points. Moreover, the fibres may be staple fibres or continuous filaments and may be formed of synthetic organic polymeric resins such as nylon, polyesters, polyolefins and other synthetic resins as well as from cotton, rayon or other natural fibres. The outer layers, before lamination, advantageously have between 40% and 95% voids and between 20% and 100% by weight of the fibres of the total fibrous layers present are embedded in and coated by the regenerated cellulose of the matrix and the coating of each individual fibre of the outer layer fibres by the matrix cellulose advantageously does not exceed 0.005 inch thickness. The laminated end product advantageously weighs between 40 and 300 grams per square meter. Where the outer layers are woven or knitted each layer advantageously has a thickness between 0.005 and 0.015 inch and has between 36 and 450 meshes per square inch.

Further according to the invention there is provided a method of producing a soft water absorbent product comprising a three dimensional reticulated matrix of regenerated cellulose bonded fibres which process comprises forming a foamed viscose having staple reinforcing fibres distributed therethrough and preferably having an alkalinity corresponding to a ratio of sodium hydroxide to the cellulose dissolved in the viscose exceeding 0.9:1.0, applying the foamed viscose to at least one layer of fibres, at least partially embedding the fibrous layer in the fibre-containing cellulose layer and regenerating the cellulose in the viscose. The foaming is advantageously and preferably primarily effected by admixing the viscose with reinforcing fibres and a surfactant and whipping the resultant mixture to incorporate and disperse air therein and reduce its specific gravity which is initially 1.3 to between 0.6 and 0.15. It has been found that the viscose should preferably have a higher alkalinity than the normal alkalinity of viscose, that is it should preferably possess a ratio of sodium hydroxide to cellulose dissolved in the viscose exceeding 0.9:1.0, and an alkalinity corresponding to a ratio of sodium hydroxide to the viscose cellulose and reinforcing cellulose fibres exceeding 0.7:10. The dissolved cellulose preferably constitutes from 2% to 10% by weight of the viscose and the alkalinity is between 1.8% and 25%. The high alkalinity permits the production of a product with a high proportion of regenerated cellulose possessing great softness and pliability both wet and dry.

The laminate of outer fibrous webs and inner viscose foam may be compressed by passing it between suitably biased squeeze rolls or between belts or webs which are squeezed together. The compressed laminate is then passed through a suitable coagulating and regenerating bath, for example, an aqueous solution containing from 10% to 28% sodium sulphate and from 0.5 to

2.5% sulphuric acid, advantageously at an elevated temperature, preferably between 90°C and 100°C to coagulate and regenerate the viscose and the resulting product is then washed, bleached and dried. It has been found that the use of high bath temperature results not only in a greater coagulation and regeneration speed but also in a softer product of reduced density and other desirable properties.

Where a relatively thick product is desired it is advantageous to admix with the foamed viscose sodium sulphate decahydrate crystals. These crystals may have an average size up to ¼ inch and may constitute up to 8 times the weight of the viscose and the reinforcing fibres contained therein. Moreover, the improved product may contain more than two fibrous layers, for example, three or more, and such product is produced by forming a laminate of alternate layers of fibrous webs and viscose foam with the fibrous webs forming the outer layers as well as one or more inner layers and then proceeding in the manner described above.

A highly advantageous method of forming the laminate of fibrous outer layers and viscose foam matrix layers where the outer layers are of randomly oriented fibres is to deposit a first layer of randomly oriented fibres onto a substrate by means of a Rando web forming apparatus, deposit a layer of the foamed viscose mixture onto the first layer and deposit by means of the Rando machine a second layer of randomly oriented cellulose fibres onto the viscose foam layer. The substrate may be a perforate belt or screen and the laminate is compressed while being advanced on the substrate belt by means of an upper superimposed belt or pressure roller. The foamed viscose layer is of a thickness depending on that of the desired end product.

The improved product of the present invention possesses an extremely fast water take-up, a very high water retention, is highly porous, and is soft and strong in both a dry and wet state and is lint free and highly abrasion and wear resistant. It is boilable and launderable, is easily disinfected and sterilized and may be dyed, printed, sewn, glued, cemented and otherwise treated and handled. While it is highly suitable as a wiping and wash cloth it possesses numerous other applications. It is highly useful for clothing, bed linens, surgical pads, filters, and other applications and may be impregnated with many active materials.

The following examples illustrate the present invention.

## EXAMPLE I

Viscose containing 4.25% cellulose, 15.8% sodium hydroxide and 1.85% sulphur originating in the $CS_2$ employed in the viscose preparation was prepared in a conventional manner. The viscose had a viscosity of 8 seconds as determined by a known method using a ¼ inch steel ball and a 20 centimeter fall. 2% by weight of the surfactant diethanol amine of capric acid (Nopco GLN) (The word 'Nopco' is a Registered Trade Mark) was mixed with the viscose.

Finely divided cellulose pulp fibres were produced by disintegrating in a hammer mill a 91% alpha cellulose bleached Kraft wood pulp (Buckeye Cellulose E-1). The cellulose fibres possessed the following screen analysis:

| | | |
|---|---|---|
| On | 14 Mesh | 48.4% |
| On | 28 Mesh | 33.4% |
| On | 48 Mesh | 9.9% |
| On | 100 Mesh | 4.7% |
| Through | 100 Mesh | 3.6% |

Ten pounds of the surfactant containing viscose were mixed in a kneader for 15 minutes to partially foam and increase the volume of the viscose. Thereafter, 1.25 pounds of the disintegrated pulp were added to the viscose and the mixing continued for another 45 minutes during which the main foaming occurred and the foamed mass reached a specific gravity of 0.34.

A first fleece of randomly oriented loose cotton fibres was deposited in the known manner on a Teflon (the word 'Teflon' is a Registered Trade Mark) coated screen, the fleece having a weight of 15 grams per square meter. A layer of the foamed viscose mass of a thickness corresponding to 600 grams per square meter was uniformly deposited on the first fleece and a second fleece, similar to the first fleece, was then deposited on the viscose mass layer. A second Teflon coated screen was deposited on the viscose fleece laminate and the assembly was advanced between a pair of rubber coated squeeze rollers at a pressure of 30 pounds per square inch.

The squeezed screen and laminate assembly was then directed into a coagulation and regeneration bath at 100°C and containing 2% sulphuric acid and 26% sodium sulphate. After immersion in the bath for three minutes the assembly was removed and the laminate separated from the screens and subjected to a suitable after-treatment including the steps of desulphurizing, bleaching, antichlor treatment, washing and drying.

The resulting product was soft when wet or dry and possessed a very high wet and dry strength and consisted of 18.7% regenerated cellulose, 56.3% pulp fibres, 25% cotton fibres and had a weight of 120 grams per square meter.

## EXAMPLE II

The procedure of Example I was followed

using a viscose containing 6.2% cellulose, 7.3% sodium hydroxide and 2.7% sulphur and having a viscosity of 27 seconds. The foamed mass contained 2.6% of the surfactant and 0.22 pounds of the disintegrated pulp fibres in ten pounds of the viscose. The outer cotton webs and the viscose mass layer were compressed under four pounds per square inch pressure. In all other respects the method of Example I was followed.

The resulting product contained 31.5% of the outer cotton webs, 51.5% regenerated cellulose and 17.0% pulp fibres and weighed 95 grams per square meter. It had a wet strength of 8.8 pounds per inch, a water absorption of 1840% and was soft and supple in both a wet and dry state.

## EXAMPLE III

A mass was produced in the manner of Example I by adding to a viscose composition containing 6.8% dissolved cellulose and 12.3% NaOH, shredded pulp (Buckeye Cellulose E-1) in a ratio of 1:1 to the dissolved cellulose and, 0.4% of the weight of the viscose of a wetting agent such as Nopco GLN or Rohm and Haas Triton BG5 (the word "Triton" is a Registered Trade Mark) and by kneading the mixture to inject air and bring the specific gravity of the mass to 0.5.

The foamed mass was laminated between two layers of cotton scrim of 8×6 per inch construction and of a weight of 11 grams per square meter in the manner of Example II and the laminate was treated in a 20% sodium sulphate solution containing 50 grams per litre sulphuric acid and at a temperature of 98°C., to regenerate the cellulose in the viscose. After the regeneration step the material was subjected to an aftertreatment consisting successively of a water wash, a desulphurizing treatment with a caustic soda solution of 10 grams per litre at 85°C, a water wash, and a bleach by a sodium hypochlorite solution at 30°C with 2 grams per litre of active chlorine. The material was then plasticized, if desired, and dried.

The resulting sheet is a soft, strong highly water absorbent cloth with a weight of 160 grams per square meter.

## EXAMPLE IV

A foamed mass having a specific gravity of 0.5 was produced in the manner of Example III in which the viscose contains 6.1% dissolved cellulose, 12.3% sodium hydroxide, the shredded pulp (Buckeye Cellulose E-1) was in the ratio of 1:1 to the dissolved cellulose and a wetting agent (Rohm and Haas Triton BA5) equivalent to 0.3% of the viscose was used.

The foamed mass was sandwiched between two layers of nylon netting of 12.5 grams per square meter and 79 mesh per square inch, in the manner of Example III, and the laminate was treated in a 20% sodium sulphate solution containing 50 grams per litre sulphuric acid at 98°C to regenerate the cellulose in the viscose. After regeneration the laminate was subjected to the aftertreatment described in Example III.

The resulting product was a soft, strong, highly water absorbent cloth having a weight of 115 grams per square meter.

## WHAT WE CLAIM IS:—

1. A soft, water absorbent product comprising a three dimensional reticulated matrix of regenerated cellulose bonded fibres produced by regenerating a foamed viscose having staple reinforcing fibres distributed therethrough, and a fibrous layer additionally anchored in a face of the fibre-containing regenerated cellulose matrix.

2. A product as claimed in Claim 1, wherein the foamed viscose has an alkalinity corresponding to a ratio of sodium hydroxide to the cellulose dissolved in the viscose exceeding 0.9:1.0.

3. A product as claimed in Claim 1 or 2, wherein the reticulated matrix of foamed regenerated cellulose is sandwiched between two fibrous layers.

4. A product as claimed in any of Claims 1 to 3, wherein the regenerated cellulose constitutes of between 15% and 95% of the product based on the dry weight thereof.

5. A product as claimed in any of Claims 1 to 4, wherein the staple reinforcing fibres comprise cellulose fibres having a staple length averaging between 1.5 and 4.0 millimeters.

6. A product as claimed in any of Claims 1 to 5, wherein the fibres of the fibrous layer or layers have an average staple length exceeding 10 millimeters.

7. A product as claimed in any of Claims 1 to 6, wherein the staple reinforcing fibres of the reticulated matrix of foamed regenerated cellulose are cellulose pulp fibres and the fibres of the fibrous layer or layers comprise cotton fibres.

8. A product as claimed in Claim 7, wherein the fibrous layer or layers comprise a cotton fleece of weight between 4 and 60 grams per square meter.

9. A product as claimed in any of Claims 1 to 8, wherein the fibres of the fibrous layer or layers are substantially randomly oriented.

10. A product as claimed in any of Claims 1 to 9, wherein the fibrous layer or layers comprise mesh fabrics having between 40% and 95% voids.

11. A product as claimed in any of Claims 1 to 10, wherein at least 20% by weight of the fibres of the total fibrous layers present are embedded in or coated by the matrix.

12. A product as claimed in Claim 11, wherein the coating of each individual fibre does not exceed 0.005 inch thickness.

13. A product as claimed in any of Claims 1 to 12, having a weight of 40 to 300 grams per square meter.

14. A product as claimed in Claim 10, wherein the fabric has between 36 and 450 meshes per square inch.

15. A product as claimed in Claim 1 substantially as described with reference to any of the Examples.

16. A method of producing a soft, water absorbent product comprising a three dimensional reticulated matrix of regenerated cellulose bonded fibres which process comprises forming a foamed viscose having staple reinforcing fibres distributed therethrough, applying the foamed viscose to at least one layer of fibres, at least partially embedding the fibrous layer in the fibre-containing cellulose layer and regenerating the cellulose in the viscose.

17. A method as claimed in Claim 16, wherein the foamed viscose has an alkalinity corresponding to a ratio of sodium hydroxide to the cellulose dissolved in the viscose exceeding 0.9:1.0.

18. A method as claimed in Claim 16 or 17, wherein the foamed viscose is sandwiched between two layers of fibres.

19. A method as claimed in any of Claims 16 to 18, wherein the staple reinforcing fibres are cellulosic.

20. A method as claimed in any of Claims 16 to 19, wherein the foam contains a surfactant.

21. A method as claimed in Claim 16, substantially as described wih reference to any of the Examples.

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